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## Effectiveness of an education programme by a general practice assistant for asthma and COPD patients: results from a randomised controlled trial

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### Abstract

In this study a randomised controlled trial was carried out to investigate the effectiveness of an education programme for patients with asthma or chronic obstructive pulmonary disease (COPD). All asthma and COPD patients using medication and experiencing pulmonary symptoms were randomly assigned to the intervention ( $n = 139$ ) or usual-care group ( $n = 137$ ). The intervention consisted of tailor-made education conducted by a general practice assistant and focussing on a patients' technical skills and coping with the disease. Measurements took place at baseline, and after 1 and 2 years of follow-up. After 1 and 2 years the inhalation technique was significantly better in the intervention group compared to the usual-care group. No significant differences were observed regarding disease symptoms, health related quality of life, compliance, smoking cessation, self-efficacy, and coping. The results only support the implementation of the intervention regarding the technical skills (inhalation technique). However, given the importance of improvement of patients' coping and the need for more efficient care, we recommend further exploration of the possibilities of a more structured and intensive education programme.

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**Keywords:** Asthma; Chronic obstructive pulmonary disease (COPD); Primary health care; Patient education; Randomised controlled trial

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### 1. Introduction

A substantial discrepancy between provided care and guidelines for adequate treatment has been demonstrated in patients with (mild to moderate) asthma or chronic obstructive pulmonary disease (COPD) in primary care [1,2]. Previous research reported undertreatment, insufficient patient knowledge (about disease, prescribed medication, and triggers provoking exacerbation), poor compliance, and an incorrect inhalation technique [1,3–5]. Health education by the general practitioner (GP) usually occurs in the early phase of the disease, or when patients present themselves

with an exacerbation [2,6]. Without sufficient follow-up, information may not be easily understood or retained. The undertreatment of patients with asthma and COPD has also been attributed to the relative complex treatment schedule and the high workload of Dutch GPs, as a result of which disease-specific education may often be neglected [7,8].

Recent reviews have shown that programmes containing information only, given through a video, booklet or computer, do not improve health outcomes [9]. Extensive self-management programmes overall did lead to an improvement of most health outcomes [10,11]. However, almost all reviewed programmes were carried out among more severely ill patients, whereas the majority of patients have mild to moderate asthma or COPD and are treated in primary care [10,11]. More seriously diseased patients are seen by a specialist on a regular basis and are probably

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more motivated, creating better opportunities to integrate self-management programmes into daily care [12,13]. Nevertheless, patients in primary care do need extra care, and might benefit from a less extensive programme.

The GP-assistant in The Netherlands gives administrative support to the GP and assists in minor medical interventions. In order to improve care, create easily accessible care for patients, and unburden the GPs, tasks can be delegated to well trained GP-assistants [14]. We developed a brief education programme provided by a GP-assistant, that addresses individual knowledge and skills regarding the disease, medication, compliance, inhalation technique, smoking behaviour and management of disease specific problems which in turn may also positively influence coping and self-efficacy. This paper reports on a randomised controlled trial (RCT) on the effectiveness of this education programme on disease symptoms and HRQoL, by comparing it with usual-care.

## 2. Material and methods

### 2.1. Patient selection

Fourteen GPs from 12 general practices in The Netherlands selected patients with asthma or COPD from their practice records using the following inclusion criteria: a clinical diagnosis of asthma, COPD or mixed disease (asthma with persisting airway obstruction) [15], age 16–75 years, treated by the GP, and the absence of other specific pulmonary or terminal diseases. All patients were invited for a baseline assessment between January 1998 and January 1999. Based on this assessment, only patients who reported current use of asthma or COPD medication and experienced disease symptoms in the past year, like cough and phlegm production or dyspnea, were included in the study.

### 2.2. Randomisation and blinding

Enrolled patients were stratified according to age, and randomly allocated to either the intervention or usual-care group in blocks of ten. The randomisation was carried out by an independent person using anonymised patient numbers. Neither the researcher, nor the data collectors were informed about the assignment.

### 2.3. Education programme

The intervention was carried out by two GP-assistants. The education level of a GP-assistant in The Netherlands is low to medium and consists of secondary school plus two years GP-assistant training. Preceding and during the trial the GP-assistants did receive extra training accomplished by an experienced GP, and included role-play with video feedback. The patients allocated to the intervention group were invited for a consultation with their GP who recorded information about the diagnosis, medication and circum-

stances causing hyperreactivities. Subsequently, one to four semi-structured consultations of 30 min with a GP-assistant took place. The content and number of these consultations were based on the nature (asthma, COPD or mixed disease) and seriousness of the disease and the needs and wishes of the patient. The GP was asked to record the diagnosis of the disease. The GP-assistant was well instructed and trained to deal with the differences between the diseases asthma and COPD. The GP-assistant used a semi-structured protocol containing the following topics: (a) information about the disease, prescribed medication, compliance, and (specific and/or a-specific) hyperactivity; (b) control and instructions on patient's inhalation technique using a standardised checklist developed by the Dutch Asthma Foundation [3]; (c) discuss barriers in coping with the disease, such as how to deal with smoking colleagues; (d) a supportive smoking cessation programme was offered to smokers [16]; and (e) advice about when to consult a doctor. Finally, if applicable, free booklets (of the Dutch Asthma Foundation) addressing specific topics such as 'how do I inform my social environment', 'use of medication', or 'dealing with allergy', were provided and discussed. During each consultation the GP-assistant registered on a checklist how well topics were discussed. All consultations were carried out before the end of year one. Patients in the usual-care group continued to receive usual-care from their GPs.

### 2.4. Measurements

Informed consent was obtained before baseline measurements. Extensive measurements took place before randomisation and after 1 and 2 years follow-up.

#### 2.4.1. Baseline characteristics

Information about education level, duration of their disease, hyperactivity (triggers such as smoke and change in temperature), and other chronic diseases were gathered in a face-to-face interview. The presence of allergy was defined by a positive Phadiathop test (Pharmacia AB, Uppsala, Sweden) [17]. The forced expiratory volume in one second (FEV1) was measured and expressed as a percentage of the predicted FEV1 ( $FEV1\%_{predicted}$ ) using the adult predicted normals of the European Coal and Steel [18]. The peakflow expiratory flow rate (PEFR) was measured every morning and evening with a hand-held spirometer and recorded every three months, over a two week period, on a diary chart [18]. Variability in PEFR was expressed as lowest morning PEFR recorded during 14 days and expressed as percent of the predicted [18,19].

#### 2.4.2. Primary outcome measures

In a face-to-face interview, the *degree of dyspnea* was assessed using the Medical Research Council (MRC) questionnaire (scale from 0 (no dyspnea) to 4 (very serious dyspnea)), followed by questions about *wheezing* (never, ever, or most days and nights), and *chronic cough or phlegm*

production (present, not present) [18]. *HRQoL* was measured using the written, disease-specific Quality of Life in Respiratory Illness Questionnaire, which contains 55 items divided into seven subscales related to breathing problems, physical problems, emotion, general activity, situation triggers, daily and domestic activities, and social activities [20]. For every item, the extent to which the patient was troubled due to pulmonary complaints was rated from 1 (not bothered at all) to 7 (very much bothered). The subscales were calculated separately and added to an overall scale (range: 7–49). Finally the scale was transformed so that a low score indicates poor *HRQoL*. Using a 2-week diary chart, day or night disturbance due to respiratory complaints was measured (no disturbance, disturbance on more than one day or night) [18]. Finally, the use of  $\beta$ -agonists was registered (use on more or less than 4 out of 14 days) [18].

#### 2.4.3. Secondary outcome measures

To measure *inhalation technique* a 10-item validated inhaler-specific checklist was used [4]. A correct inhalation technique was defined as less than two negative scores on the checklist. Inhalation technique could not be measured at baseline since it was considered to be ethically incorrect to check a patient's inhalation technique without adjusting it when it was incorrect. Information about medication was gathered from the face-to-face interview and categorised afterwards according to step-care therapy rules (step 1:  $\beta$ -agonists only; step 2: low or moderate dose corticosteroids or cromoglycerine; step 3: moderate dose corticosteroids or cromoglycine and long acting  $\beta$ -agonists; step 4: high dose corticosteroids or cromoglycine with long acting  $\beta$ -agonists) [15]. In a written questionnaire, information was gathered about *compliance* with anti-inflammatory agents using a standardised three-item checklist (compliant or not compliant), and on smoking behaviour (never, former, current). *Self-efficacy* was measured using a disease-specific questionnaire assessing personal judgements of how well one can implement adequate behaviour in situations that involve unpredictable, or stressful elements (range: 0–170) [21]. Finally, a *coping style* questionnaire was used to measure how people deal with their disease in everyday life and is subcategorised in: (a) avoidant or passive coping style (range: 0–48); (b) rational or problem-focussed coping style (range: 0–36); and (c) emotional coping style (range: 0–18) [22].

#### 2.5. Statistical analyses

Study size calculation was based on the ability to detect a difference in the mean improvement in favour of the intervention group of 10% on the *HRQoL* scale. To detect a difference of 10%, a two-sided significance level ( $\alpha$ ) of 0.05 and a power ( $1 - \beta$ ) of 0.80, approximately 110 subjects per group (total 220) were needed. Taking into account a maximum dropout rate of 20% our goal was to include 132 subjects per group.

Analyses were based on intention-to-treat. Possible prognostic differences between the intervention and usual-care group were checked at baseline. Change scores were calculated over all outcome measures. To determine the effectiveness of the intervention after 1 and 2 years follow-up, adjusted for possible clustering of observations within GPs, linear and logistic multi-level analyses were performed using *MLwiN*. The included levels were: (a) patient, (b) GP, and (c) GP-assistant. When the levels GP and GP-assistant did not influence outcome, standard linear and logistic regressions were used. Differences between groups on variables evaluated by the diary charts were analysed when at least three of the nine charts were available, using multi-level analysis with time as an additional level.

Finally, subgroup analyses were conducted to investigate whether the treatment effect varied between patients with the diagnosis of asthma and COPD (including COPD and mixed disease) and between males and females. Another subgroup analysis was conducted to analyse the effect of the number (only one or at least two) of consultations with the GP-assistant.

### 3. Results

#### 3.1. Recruitment

Of the 663 patients selected by the GPs and invited for baseline assessment, 124 could not be contacted, while 63 refused to participate (Fig. 1). Among the non-responders, there were significantly more males and younger patients. Of the 476 patients assessed, 276 (58%) patients met all inclusion criteria and were randomly allocated to either the intervention ( $n = 139$ ) or usual-care group ( $n = 137$ ).

After one year 17% in the intervention group versus 31% in the usual-care group were lost to follow-up, after 2 years these percentages were 31% versus 42% (Fig. 1). Patients with only a baseline measurement ( $n = 67$ ) were compared to those with at least one follow-up measurement ( $n = 209$ ). More patients in the usual-care group and more (ex-)smokers dropped out from the study ( $p < 0.01$ ). There were no differences in baseline characteristics between patients lost to follow-up in the intervention group compared to those in the usual-care group.

#### 3.2. Treatment during the intervention

Of the intervention group 12 patients (9%) did not participate in the intervention; three refused, five moved, and four could not be reached. The number of consultations with the GP-assistant differed, 47 patients had one, 55 had two and 25 had more than two consultations. Problem-specific booklets were handed out to 99 patients. According to the registration-form of the GP-assistant, at the final consultation 79% of the patients had a sufficient inhalation technique, and most patients sufficiently understood their

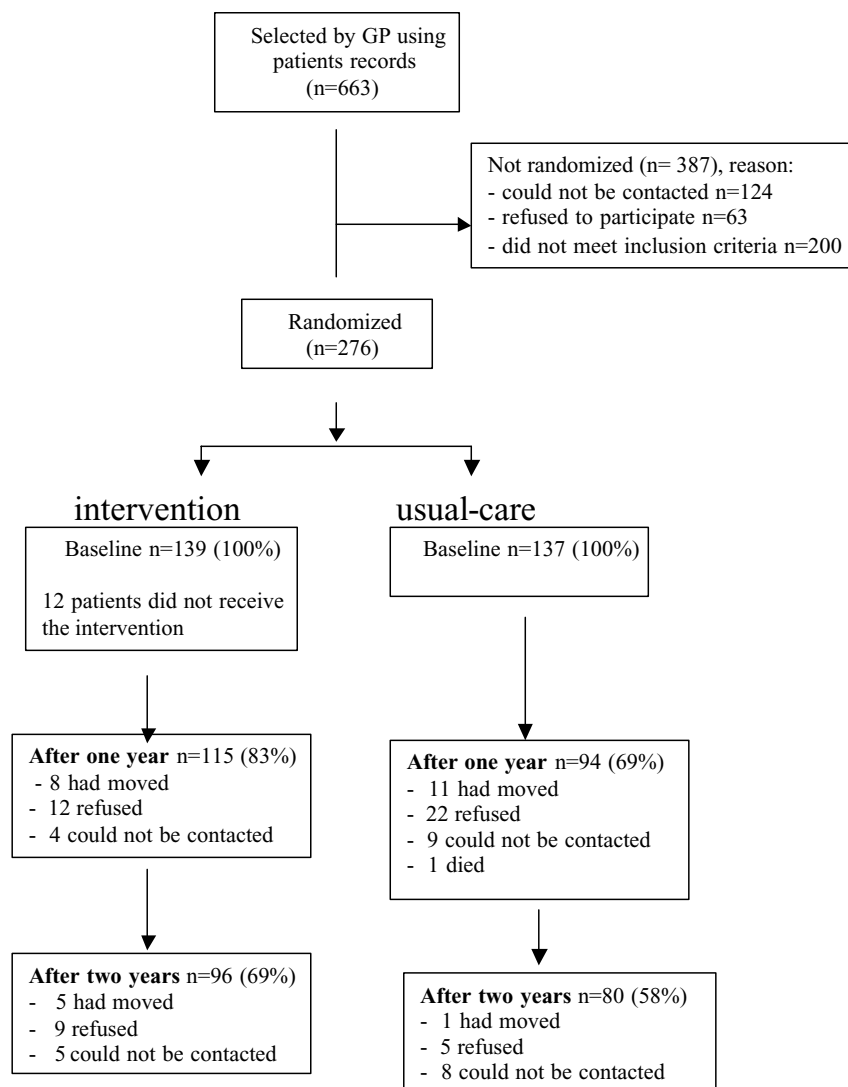


Fig. 1. Flow chart of patients.

disease (78%), hyperreactivity (78%), and the reason for using a bronchodilator (93%) or corticosteroids (78%).

Multilevel analysis at 1 and 2 years follow-up on all outcomes showed that observations were independent and not influenced by the different GPs or GP-assistants (data not shown). Furthermore, there were no substantial differences between the intervention and the usual-care group regarding demographic, clinical, or pulmonary function variables (Table 1). There was only a small difference in baseline score for self-efficacy, which did not influence the outcomes (data not shown). Therefore, unadjusted estimates of differences between groups were presented for all outcome measures.

### 3.3. Primary outcome measures

Only small differences were found in changes of disease symptoms after 1 and 2 years (Tables 2 and 3). HRQoL

did not change much during the 2 years follow-up and no significant differences were found between both groups after 1 (−0.3, 95% CI = −1.8, 1.1) and 2 years (−1.2, 95% CI = −2.9, 0.6) (Table 3). Additional analyses regarding the subscales of the HRQoL questionnaire also showed no significant differences. There were small, but insignificant differences between the intervention and usual-care group regarding changes in self-efficacy and coping style in favour of the intervention group.

### 3.4. Secondary outcome measures

Significantly more patients in the intervention group versus the usual-care group had a correct inhalation technique after one (66% versus 50%) and two years (75% versus 59%) follow-up (Table 2). Compliance after 1 and 2 years was slightly better in the intervention group. The incidence of smoking cessation was similar in both groups. Four of

Table 1  
Baseline characteristics of participants

	Intervention ( <i>n</i> = 139) <i>n</i> (%) or mean $\pm$ S.D.	Usual-care ( <i>n</i> = 137) <i>n</i> (%) or mean $\pm$ S.D.
Demographic variables		
Gender: male	49 (35)	39 (28)
Age (years)	49.9 $\pm$ 14.2	44.7 $\pm$ 13.6
Education level (years)	4.2 $\pm$ 1.6	4.2 $\pm$ 1.6
Smoking		
Never	52 (39)	51 (37)
Former	39 (29)	47 (35)
Current	45 (32)	38 (28)
Clinical variables		
Diagnosis GP		
Asthma	93 (67)	99 (72)
COPD	26 (19)	21 (15)
Mixed disease	20 (14)	17 (13)
Duration of disease (years)	20.8 $\pm$ 16.9	20.6 $\pm$ 15.9
Allergy present	73 (55)	66 (50)
Aspecific hyperreactivity present	104 (77)	99 (75)
Medication (stepped-care therapy) <sup>a</sup>		
Step 1	22 (16)	21 (15)
Step 2	81 (59)	74 (55)
Step 3	28 (20)	30 (22)
Step 4	7 (5)	10 (7)
Other chronic disease	61 (44)	68 (50)
Pulmonary function		
Pre-FEV1%predicted	81.9 $\pm$ 22.6	84.7 $\pm$ 23.4
Peakflow (low (morning)%predicted) measured over 14 days ( <i>n</i> = 222)	77.1 $\pm$ 19.7	77.2 $\pm$ 21.8
Primary outcome measures		
Presence of chronic cough or phlegm production in the last year	54 (39)	49 (36)
Wheezing most days and nights	27 (19)	31 (23)
>1 day or night with respiratory complaints during previous 2 weeks ( <i>n</i> = 222)	56 (57)	55 (59)
Use of $\beta$ -agonists in >4 days during previous 2 weeks ( <i>n</i> = 222)	66 (64)	77 (72)
Dyspnea grade (scale: 0–4)	1.4 $\pm$ 1.3	1.4 $\pm$ 1.3
Health related quality of life (scale: 7–47)	39.1 $\pm$ 7.1	39.3 $\pm$ 7.1
Secondary outcome measures		
Number of not compliant patients ( <i>n</i> = 227) <sup>b</sup>	55 (53)	54 (54)
Self-efficacy ( <i>n</i> = 194)	78.7 $\pm$ 27.4	85.8 $\pm$ 27.2
Coping styles ( <i>n</i> = 191)		
Avoidance	25.2 $\pm$ 9.9	25.1 $\pm$ 10.4
Rational reaction	23.4 $\pm$ 6.8	23.0 $\pm$ 7.8
Emotional reaction (mean (IQR)) <sup>c</sup>	2.0 (1.0–5.0)	2.0 (0.0–4.0)

GP: general practitioner; COPD: chronic obstructive pulmonary disease; Pre-FEV1%predicted: forced expiratory volume in one second (FEV1) as a percentage of the predicted FEV1.

<sup>a</sup> Step 1:  $\beta$ -agonists only; Step 2: low or moderate dose corticosteroids or cromoglycine; Step 3: moderate dose corticosteroids or cromoglycine and long acting  $\beta$ -agonists; Step 4: high dose corticosteroids or cromoglycine with long acting  $\beta$ -agonists.

<sup>b</sup> Only those using anti-inflammatory agents.

<sup>c</sup> Median and Inter-Quartile Range (IQR; 25th, 75th percentile) are presented as data are not normally distributed.

the 45 patients in the intervention group who smoked at baseline stopped smoking versus six out of the 38 in the usual-care group. After 1 year 21% of the patients in the intervention group versus 10% in the usual-care group adjusted their medication to a higher step. These proportions were 12% versus 21% after 2 years, compared to baseline. Reduction in medication was seen in 18% in both groups after 1 year and in 16% of the patients in the in-

tervention group versus 34% in the usual-care group after 2 years.

At least three day-charts were returned by 174 patients. The course of symptoms was highly variable over time in both groups. There were no significant group differences regarding the number of days or nights disturbed (OR = 0.96; 95% CI = 0.56, 1.61), or daily use of  $\beta$ -agonists (OR = 1.03; 95% CI = 0.52, 2.01) over time.



Table 2

Change since baseline of categorical data after 1 and 2 years follow-up for both the intervention (IG) and usual-care (UC) group

Study group	Number (%)		Differences (IG – UC) (%) [95% CI]	
	After 1 year	After 2 years	After 1 year	After 2 years
Primary outcome measures				
No chronic cough and phlegm production or an improvement				
IG	43 (40)	41 (44)	–6 [–20, 8]	2 [–13, 17]
UC	39 (46)	33 (42)		
No wheezing or an improvement				
IG	68 (64)	53 (57)	4 [–9, 17]	10 [–5, 25]
UC	51 (60)	37 (47)		
Secondary outcome measures				
Correct inhalation technique <sup>a</sup>				
IG	63 (66)	58 (75)	16 [2, 31]	16 [1, 32]
UC	37 (50)	36 (59)		
Compliant or an improvement in compliance <sup>b</sup>				
IG	38 (60)	30 (52)	10 [–10, 28]	9 [–11, 29]
UC	22 (50)	17 (43)		

<sup>a</sup> No information was gathered about inhalation technique at baseline so no change scores after 1 and 2 years could be calculated.

<sup>b</sup> Compliance was only measured among those using anti-inflammatory agents.

### 3.5. Subgroup analysis

Subgroup analysis regarding diagnosis asthma and COPD showed no differences in outcome across these groups. In addition, no different effect of the education programme could be demonstrated between male and female patients. Subgroup analysis comparing the number of consultations

with the GP-assistant (47 patients with one consultation versus 80 patients with at least two consultations), showed no differences between groups after one year, but patients with at least two consultations made less mistakes in their inhalation technique after two years follow-up (66% versus 80%).

## 4. Discussion and conclusion

The education programme developed for primary care patients with asthma or COPD resulted in only small and non-significant changes on disease symptoms or HRQoL. Inhalation technique, which is required for good disease control, was significantly better in the intervention than in the usual-care group.

### 4.1. Discussion

Because of randomisation, we have no reason to believe that the inhalation technique was different between groups at baseline. A significantly better inhalation technique in the intervention group was seen both after 1 and 2 years. Moreover, inhalation technique was better when patients had more than one consultation with the GP-assistant. Improvement of inhalation technique may result in a greater efficacy of medication and subsequently result in better disease control and more opportunity to social participation [14,23].

Like our study, previous research has shown that a well trained GP-assistant is capable of teaching patients how to use their inhaler correctly and improve their knowledge about their disease, medication and allergy [14,15]. We did

Table 3

Change since baseline of the continuous data after 1 and 2 years follow-up for both the intervention (IG) and usual-care (UC) group

	Study group	Baseline <sup>a</sup>	Change score <sup>b</sup> (mean ± S.D.)		Differences change score (IG – UC) (%) [95% CI]	
			After 1 year	After 2 years	After 1 year	After 2 years
Primary outcome measures						
Dyspnea grade 0 to 4 (mean ± S.D.)	IG	1.4 ± 1.3	0 ± 1.3	0.2 ± 1.4	0.1 [−0.3, 0.4]	0.1 [−0.3, 0.5]
	UC	1.3 ± 1.4	0.1 ± 1.3	0.3 ± 1.3		
Health related quality of life <sup>c</sup> (mean ± S.D.)	IG	39.2 ± 6.6	0.5 ± 5.2	−0.4 ± 5.9	−0.3 [−1.8, 1.1]	−1.2 [−2.9, 0.6]
	UC	39.6 ± 6.6	0.8 ± 4.1	0.8 ± 5.3		
Secondary outcome measures						
Self-efficacy <sup>c</sup> (mean ± S.D.)	IG	78.6 ± 27.1	5.6 ± 19.0	9.5 ± 23.7	4.3 [−2.6, 11.2]	5.0 [−3.1, 13.1]
	UC	87.2 ± 26.3	1.3 ± 21.5	4.5 ± 22.9		
Coping style scales <sup>c</sup>						
Avoidance (mean ± S.D.)	IG	25.7 ± 9.9	−1.8 ± 8.7	−1.3 ± 9.9	−0.3 [−3.5, 2.8]	0.3 [−3.1, 3.7]
	UC	26.5 ± 10.1	−1.5 ± 10.6	−1.6 ± 10.1		
Rational (mean ± S.D.)	IG	23.3 ± 7.7	−2.8 ± 7.4	−2.3 ± 7.2	0.1 [−2.4, 2.5]	0.2 [−2.4, 2.8]
	UC	23.2 ± 6.9	−2.9 ± 7.6	−2.5 ± 8.1		
Emotional (median (IQR)) <sup>c</sup>	IG	1.3 (1.2, 1.8)	0.6 (−1.2, 1.6)	0.4 (−1.2, 1.3)	0.8 [0, 1.5]	0.4 [−0.5, 1.2]
	UC	1.3 (1.0, 1.5)	−0.2 (−1.2, 0.8)	0 (−1.2, 0.5)		

<sup>a</sup> Only patients with at least one follow-up measurement were included.

<sup>b</sup> Positive results on change scores indicate improvement of dyspnea, HRQoL, self-efficacy, and increasing coping scores.

<sup>c</sup> Median and Inter-Quartile Range (IQR; 25th, 75th percentile) are presented because of not normally distributed data.

not measure the level of knowledge in our study, but since knowledge has been reported to improve even in less extensive programmes, we may assume that it also improved as a result of our programme [9]. A new development in Dutch primary care is the introduction of a GP-nurse. This GP-nurse might be even more capable of carrying out our education programme, as they receive higher and more specialised education than GP-assistants.

The education programme mainly focussed on individual training regarding inhalation technique and information about the disease, medication, hyperreactivity, smoking and coping. This programme was not sufficiently intensive to influence psychosocial factors or modify behaviour of patients, which in turn might have positively influenced HRQoL. In addition, the GP-assistant was not trained to offer a self-management or pulmonary rehabilitation programme which might have been applicable and effective patients with more severe or frequent symptoms. Maybe a more intensive programme conducted by a better trained health care provider could have influenced a patients disease symptoms and HRQoL. The programme may also have been too short to influence the outcome measures. An annual follow-up consultation, which allows the GP-assistant to review the patient's knowledge, and to add information or discuss new or other problems might be beneficial [5,11].

The goals we set for our education programme were difficult to reach. For example, no improvement in compliance was achieved, and few patients stopped smoking. In a recent review Haynes et al reported that even the most effective educational interventions do not lead to large improvements in compliance [2,11]. Similarly, smoking cessation may require a more intensive intervention [16,24]. In addition, changing life style or psychosocial characteristics like self-efficacy and coping probably need a more intensive approach.

Finally, few studies among patients with more severe illness have shown a change in disease symptoms or HRQoL [6,25]. Our patients had mild to moderate symptoms and generally good HRQoL scores at baseline. Consequently, it was difficult to obtain any improvement. Thoonen et al. [26] evaluated an extensive self-management programme among asthma patients in primary care, and also could not accomplish a change in HRQoL. However, they did find less and less limited activity days in the self-management group.

No different effect of the education programme was demonstrated between asthma or COPD patients. All asthma and COPD patients received a similar education programme that was mainly aimed at the nature and severity of symptoms in each individual patient. More intensive treatments like a self-management programme have been proven to be effective in asthma patients but are still under discussion in COPD patients [15,27]. Since the differences between asthma and COPD in disease characteristics and treatment have become more established over the last decade it might

be better to develop different programmes for asthma and COPD patients [28,29].

In the year of the education programme more patients in the intervention than in the usual-care group changed their medication to a higher or lower step. In the year following the intervention the opposite occurred with more patients in the usual-care group changing their medication. The differences between the groups in changes of medication were not statistically significant. Moreover, the adjustments are difficult to interpret, as they may depend on a several factors: changes in severity of symptoms or exacerbations, type of disease (asthma or COPD), and preferences of GPs and patients regarding medication. Not all changes in the intervention group may be attributed to recommendations made by the practice assistant. Consequently, no strong conclusions can be made regarding changes in medication.

The baseline measurements showed that the randomisation worked out well in our study. Only a small number (9%) of the patients refused to participate in the education programme, which is in contrast with Youn et al who found that many asthmatics were not motivated to take part in an extensive asthma education programme [30]. A relatively large number of patients dropped out during the study. Like others, we found more drop out among (ex-)smokers and among patients in the usual-care group. No differences were found in baseline characteristics between patients lost to follow-up in the intervention or in the usual-care group. Therefore, we have little reason to believe that the dropout rate greatly influenced the main results of our study.

#### 4.2. Implications for practice

An education programme, provided by a GP-assistant for patients with mild to moderate asthma or COPD, resulted in an improved inhalation technique. However, a more extensive programme is needed to improve patients' coping with the disease as large or significant benefits for disease symptoms or HRQoL could not be demonstrated. The education programme is easy to implement, provides accessible care, more continuous and patient-tailored care, and may result in less GP consultations and reduction of the workload of GPs [31]. Therefore, we consider it worthwhile to further investigate the possibilities of a more extensive educational programme for asthma and COPD in primary care, continued for a longer period of time, and carried out by an GP-assistant or a practice nurse [2,3,8].

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